User Manual

Revision 2.000
English

Gateway / Bridge CANopen to CANopen

(Order Code: HD67121)

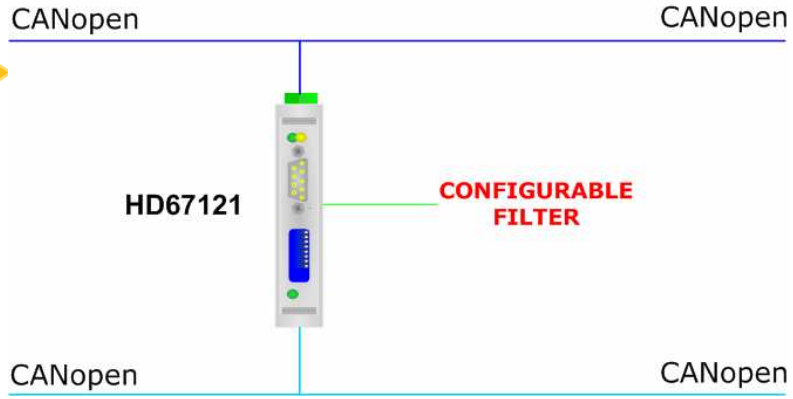
for Website information:
www.adfweb.com?Product=HD67121

for Price information:
www.adfweb.com?Price=HD67121

Benefits and Main Features:

- Very easy to configure
- Low cost
- Rail mountable
- Wide supply input range
- Galvanic isolation
- Industrial temperature range: -30°C / 70°C (-22°F / 158°F)

Logical Scheme



Similiar Products

For other Gateways / Bridges:
Canopen to Modbus / DeviceNET
See also the follwing links:

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www.adfweb.com?product=HD67002	(Modbus RTU Slave)
www.adfweb.com?Product=HD67004	(Modbus TCP Master)
www.adfweb.com?Product=HD67005	(Modbus TCP Slave)
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Benefit

Do you have an your customer protocol?
See the following links:
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Do you need to choose a device? do you want help?
Ask it to the following link:
www.adfweb.com?Cmd=helpme

INDEX:

	Page
INDEX	2
UPDATED DOCUMENTATION	2
REVISION LIST	2
WARNING	2
TRADEMARKS	2
CHARACTERISTICS	3
CONNECTION SCHEME	4
INTRODUCTION	6
USE OF COMPOSITOR SW67121	6
NEW PROJECT / OPEN PROJECT	7
SET COMMUNICATION	8
SET SDO ACCESS	10
EMCY CONFIGURATION	12
CREATION OF AN EMCY	13
TRANSLATION OF AN EMCY FROM CAN 0 TO CAN 1	14
EXAMPLE OF THE TO SETTING A FILTER FOR THE EMCY	15
SET TRANSLATE PDO	19
UPDATE DEVICE	21
CHARACTERISTICS OF THE CABLES	22
MECHANICAL DIMENSIONS	23
ORDER CODE	23
ACCESSORIES	23
WARRANTIES AND TECHNICAL SUPPORT	24
RETURN POLICY	24
PRODUCTS AND RELATED DOCUMENTS	24

UPDATED DOCUMENTATION:

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REVISION LIST:

Revision	Date	Author	Chapter	Description
1.000	03/04/2004	Ddt	All	First release version
1.010	04/10/04	Mt		
1.011	25/07/2005	Dp	All	
1.012	17/02/2006	Dp	All	
1.015	19/06/2006	Ddt	All	documentation code changed
1.016	22/06/2007	Av	All	Revision
1.017	26/06/2007	Av	All	Revision
2.000	10/07/2007	Av	All	New document format

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CHARACTERISTICS:

The CANopen to CANopen Gateway the following:

- two-directional translation of information at high levels between two distinct CANopen Buses .
- Electrical isolation between two Buses .
- The association between objects of device modules located in different buses, readable via SDO from the Gateway on the other side .
- The generation of EMCY on one side of the Gateway when there is an EMCY on the other side (originator) .
- The generation of PDO on one side of the Gateway when there is an PDO on the other side (originator) .
- Temperature range -30°C to 70°C

The CANopen to CANopen Gateway must be used for interfacing two CANopen lines. Otherwise, in order to extend the length and electrical isolation of more branches than CANopen line you must use CAN Repeater device (note: view PRODUCTS AND RELATED DOCUMENTS).

The Gateway cannot perform as Master in the network management functions. For example, it cannot begin the "start" of the network .
"Start" meaning the type of package made for carrying modules from the preoperational to the operational state.

If the two CANopen networks which connect the gateway do not have a device for a single network that acts as a Master, the Gateway cannot transmit a PDO from one network to another.
This is because a CANopen network cannot use a PDO in the "preoperational" state.

To configure the Gateway, use the available software that runs with Windows, called SW67121. It is downloadable on the site www.adfweb.com and its operation is described in this document.

The Configurable CANopen Gateway can be configured up to a maximum 1600 SDO (SDO CAN 0 + SDO CAN 1) .

While the maximum number of the following:

- EMCY
- PDO

Depend on the available memory of the Gateway and the number defined SDO.

CONNECTION SCHEME:

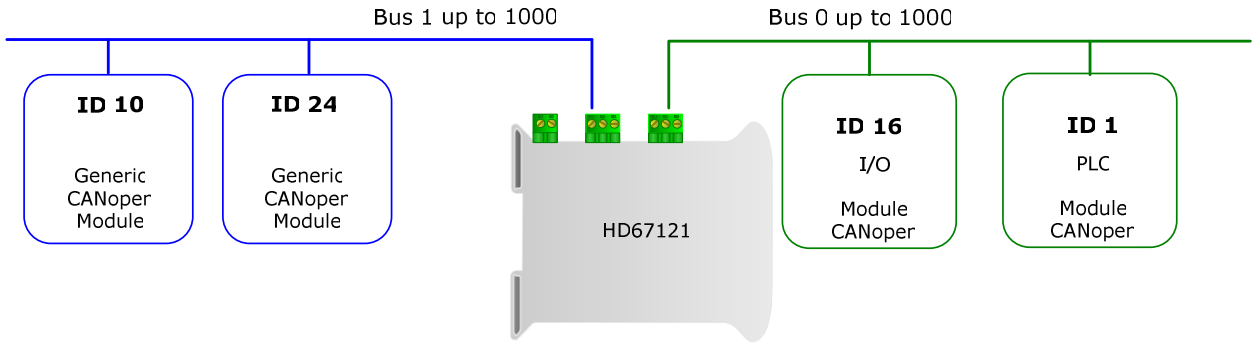


Figure 1: Connection scheme of HD67121 between CANopen and CANopen

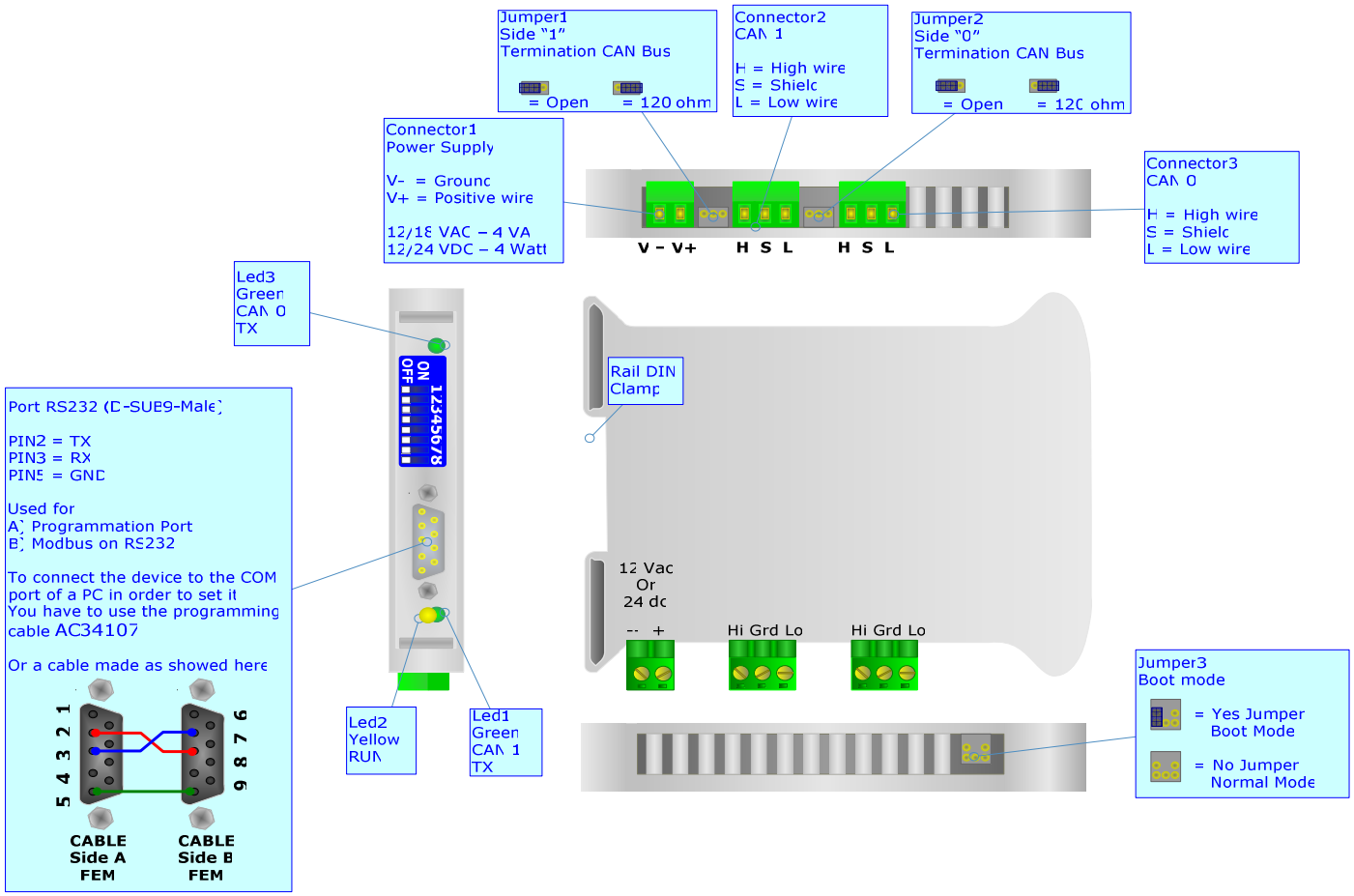


Figure 2: Connection scheme for HD67121

INTRODUCTION:

The Gateway, allows a CANopen line to communicate with another different CANopen line that we simply call CAN 0 and CAN 1 in this manual.

The two networks are symmetrical at a logical level. What CAN 0 can do to CAN 1, so can CAN 1 do to CAN 0.
CAN A and CAN B are different only on the level of hardware. One of the two CANopen has the power supply in common with the logic of the device. The other CANopen is isolated based on the logic of the device.

You need Compositor SW67121 software on your PC in order to perform the following:

- Define that the SDO of the CAN 0 are accessible from CAN 0
- Define that the SDO of the CAN 1 are accessible from CAN 0.
- Define which and how the EMCY of the CAN 0 are accessible from CAN 1.
- Define which and how the EMCY of the CAN 1 are accessible from CAN 0.
- Define which PDO of CAN 0 are accessible from CAN 1.
- Define which PDO of CAN 1 are accessible from CAN 0.
- Update the new configurations of the device.
- Save, duplicate, modify, export the configurations.

USE OF COMPOSITOR SW67121:

When launching the SW67121 the right window appears:
(The SW67121 is downloadable on the site
http://www.adfweb.com/home/download/download.asp
This manual is referenced to the last version of the software present on our web site)

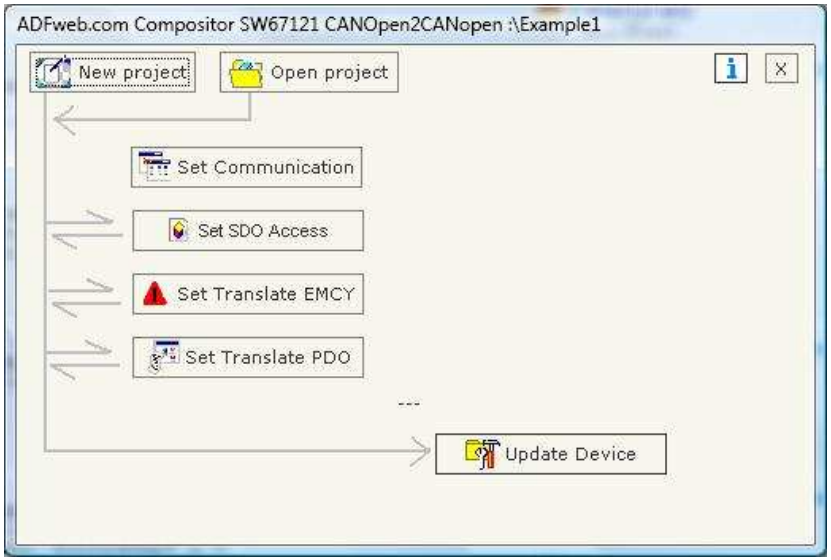


Figure 3: Main window for SW67121

The following explains the function of the buttons:

NEW PROJECT / OPEN PROJECT:

The "New Project" button creates the folder which contains the entire device configuration.
A device configuration can also be imported and exported:

- To clone the configurations of the Gateway in order to configure another Gateway device in the same manner, it is necessary to maintain the folder and all its contents.
- To clone a project in order to obtain a different version of the project, it is sufficient to duplicate the project folder with another name and open it with the button "Open Project".

When a new project is created or an existent project is open, it will be possible to access the various configuration sections of the software:

- **"Set Communication"**
- **"Set SDO Access"**
- **"Set Translate EMCY"**
- **"Set Translate PDO"**

SET COMMUNICATION:

This section defines the fundamental communication parameters of two Buses.

By pressing the "Set Communication" button from the Main window for SW67121 (Fig. 3) the window "Set Communication" appears (Fig. 4):

- In the field "DevID", the CAN address of CAN0 is defined.
- In the fields "Baud Rate", the velocity of the two Buses are defined.
- The parameter SDO timeout (1/10) is expressed in millisecond decimals so the example in the window is set at 100 ms.
- "SDO timeout" is the maximum waiting time when the device of CAN0 asks at Gateway for a SDO that comes from a device of CAN1 and CAN1's device does not respond (vice-versa if you have changed CAN1 with CAN0).

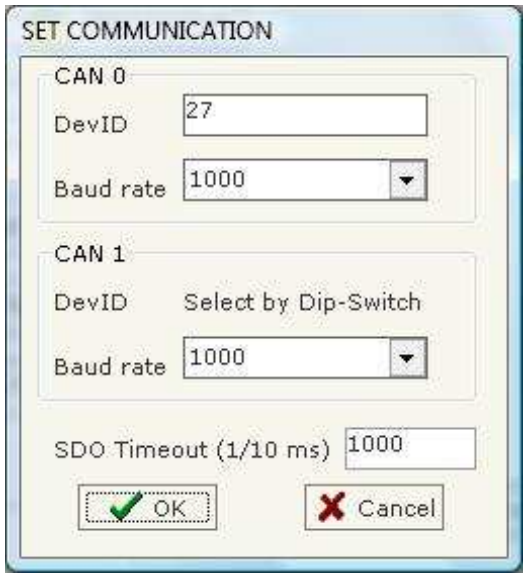


Figure 4: "Set Communication" window

DevID Select by dip-Switch

CAN1 address is defined through the dip-switch present in device. To set it you must convert the address in binary. (The address must between 1 and 127).

Example 1:

DevID=1 Binary:00000001

DevID=127 Binary:01111111

Some other examples:

DevID	Dip 1	Dip 2	Dip 3	Dip 4	Dip 5	Dip 6	Dip 7	Dip 8
1	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF
2	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF
3	ON	ON	OFF	OFF	OFF	OFF	OFF	OFF
10	OFF	ON	OFF	ON	OFF	OFF	OFF	OFF
50	OFF	ON	OFF	OFF	ON	ON	OFF	OFF
100	OFF	OFF	ON	OFF	OFF	ON	ON	OFF
127	ON	ON	ON	ON	ON	ON	ON	OFF

SET SDO ACCESS:

The following objects can be defined within the section SET SDO Access:

- The SDO of the CAN 0 are accessible also by CAN 1.
- The SDO of the CAN 1 are accessible also by CAN 0.

(note: when a SDO in the CAN 0 is defined, a SDO corresponds in the CAN 1 and vice-versa).

By pressing the "Set SDO Access" button from the Main window for SW67121 (Fig. 3) the window "Set SDO Access" appears (Fig. 5):

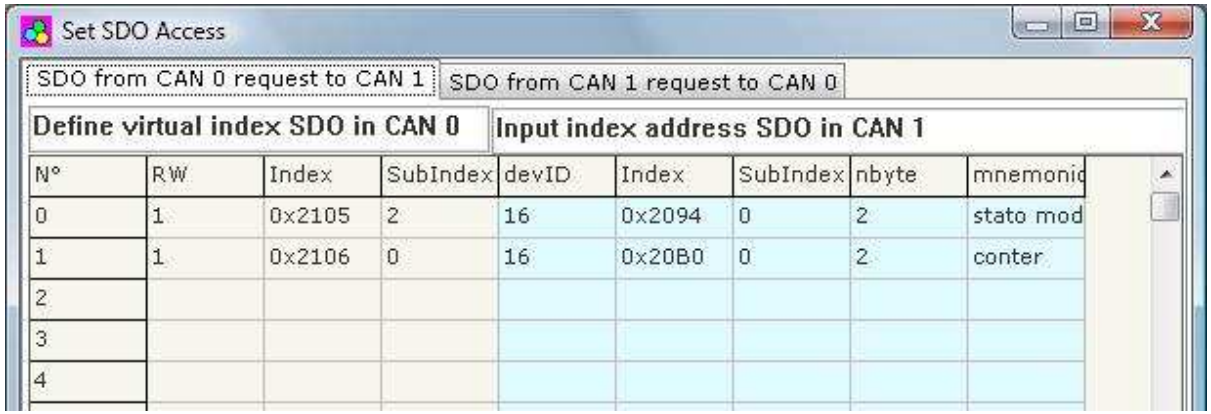

Set SDO Access
SDO from CAN 0 request to CAN 1
SDO from CAN 1 request to CAN 0
Define virtual index SDO in CAN 0
Input index address SDO in CAN 1
N° RW Index SubIndex devID Index SubIndex nbyte mnemonic
0 1 0x2105 2 16 0x2094 0 2 stato mod
1 1 0x2106 0 16 0x20B0 0 2 conter
2
3
4

Figure 5: "Set SDO Access" window

The column data has the following meaning:

- In the field "RD/WR" indicate if the data is in read/write or read only (in CAN 0)
  - The controls are done from the Gateway. If the variable on the opposite BUS is in read /write but I want to block access of the writing, I must write 0 in the cell "RD/WR". This way, even if the module where the data resides requires access in write from its side of the network, I can still block the writing on the other network.
- In the fields "Index" and "SubIndex0": are the indexes of the new object SDO that must be defined on CAN 0, because a device in CAN 0 can request an SDO from a CAN 1 device.
  - Procedures can be changed by switching CAN 0 and CAN 1 and vice-versa
- In the field "DevID": is the address of the original device of the SDO data in the CAN 1 (where the data is actually contained).
- In the fields "Index" and "SubIndex": only the coordinates of the SDO that the Gateway must read on CAN 1 to make the requested data available to the device on CAN 0.
- In the field "Nbyte" indsert the data size (this value can be 1, 2, or 4).

Example 1:
If I want to read data present in the CAN 1 network while I am in the CAN 0.
The address data in CAN 1 is the following:

- Address 16
- Index 0x2094
- SubINdex 0
- Dimension 2 Bytes

Through the gateway using the following:

- Index 0x2105
- SubIndex 2

In the above example:

The generic CANopen Module at the address 10 in the CAN 0 network reads a parameter of the CANopen module at the address 16 in the CAN 1, at the index 2094 and SubIndex 0.

The data is readable in the CAN 0 network by accessing the following:

- Address 44, in the CAN 0
- Index 2105
- SubIndex 2

The dimension of the data is specified in nByteB.

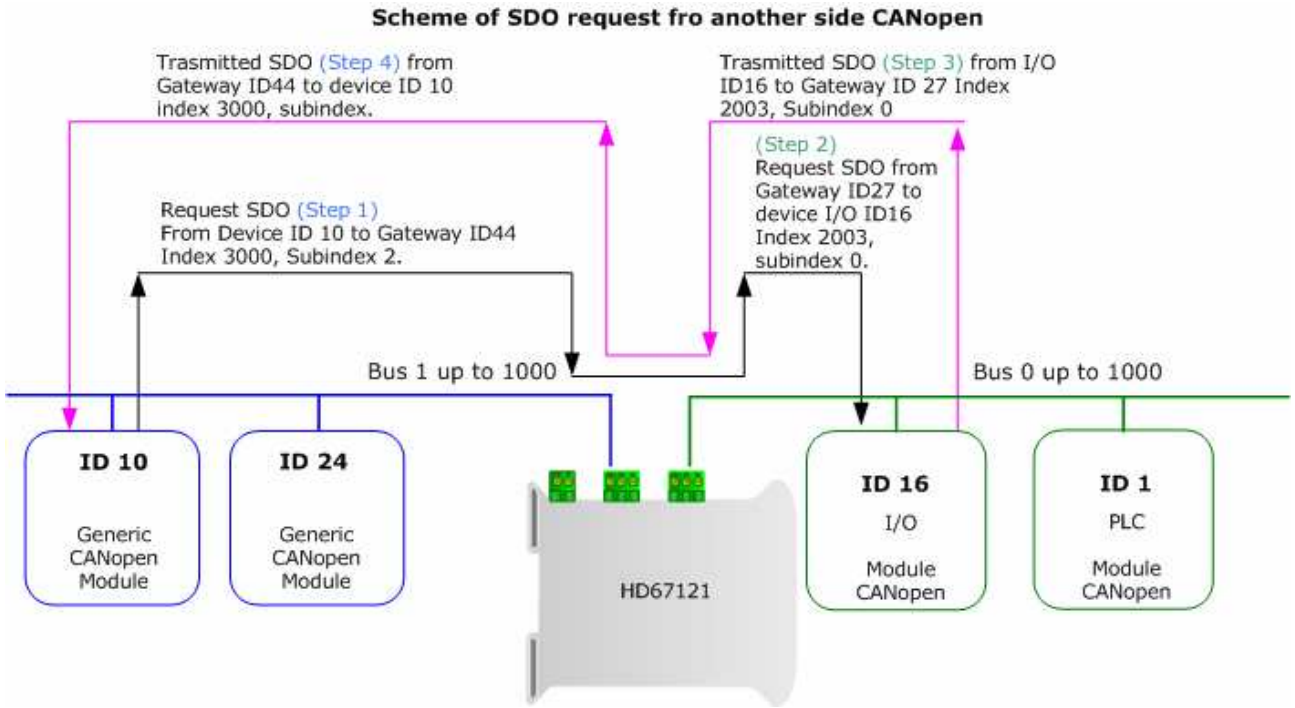

Scheme of SDO request fro another side CANopen
Trasmitted SDO (Step 4) from Gateway ID44 to device ID 10 index 3000, subindex.
Trasmitted SDO (Step 3) from I/O ID16 to Gateway ID 27 Index 2003, Subindex 0
(Step 2) Request SDO from Gateway ID27 to device I/O ID16 Index 2003, subindex 0.
Request SDO (Step 1) From Device ID 10 to Gateway ID44 Index 3000, Subindex 2.
Bus 1 up to 1000
Bus 0 up to 1000
ID 10
Generic CANopen Module
ID 24
Generic CANopen Module
HD67121
ID 16
I/O
Module CANopen
ID 1
PLC
Module CANopen

Figure 6: Chart of SDO request from CANopen sides

EMCY CONFIGURATION:

By pressing the "Set Translate EMCY" button from the Main window for SW67121 (Fig. 3) the window "Set Translate EMCY" appears (Fig. 7):

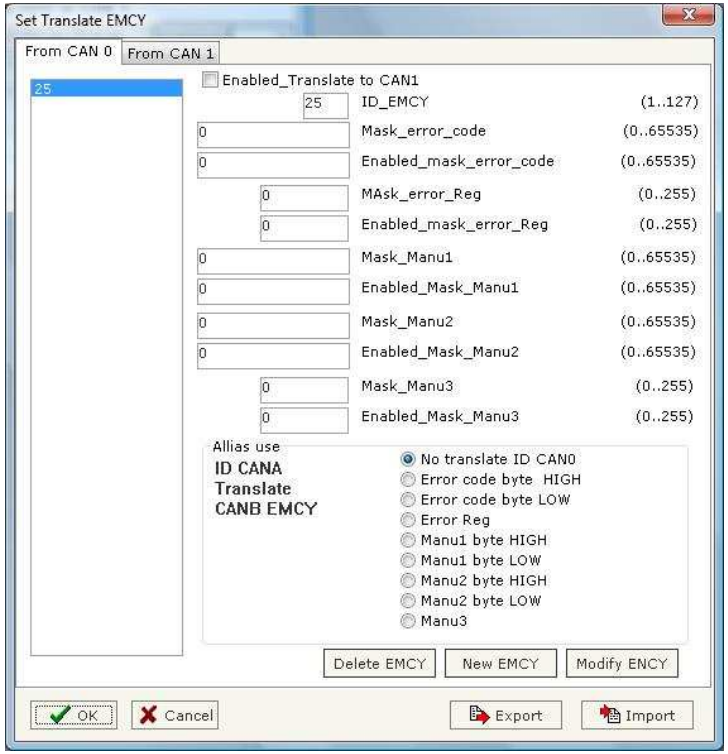


Figure 7: "Set Translate EMCY" window

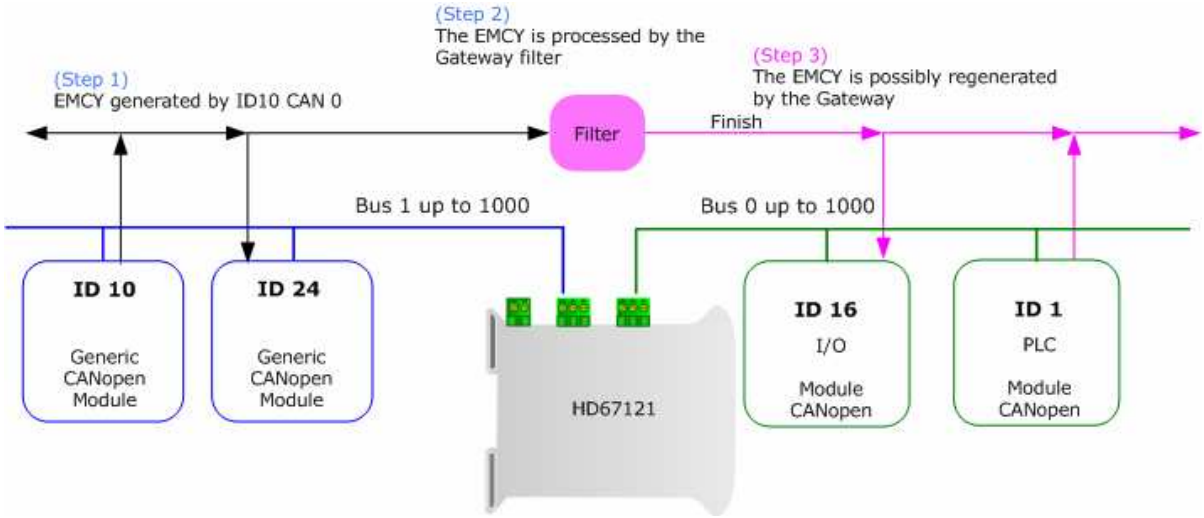


Figure 8: Propagation scheme of an EMCY from CAN 0 to CAN 1

CREATION OF AN EMCY:

In order to intercept the EMCY of the device, it is necessary to first define the EMCY and then fill in the window "SET Translate EMCY" as desired.

Use the botton "New EMCY" to define a new EMCY.

DEFINING STRUCTURE OF THE EMCY REGISTERS

Reg.	Descriz.	Mascaras filtro Gateway	Dimension del registro
1	ID	ID_EMCY	7 bit
2	Error_code	Mask_Error_Code	16 bit
3	Error_reg	Mask_Error_Reg	8 bit
4	Manu1	Mask_Manu1	16 bit
5	Manu2	Mask_Manu2	16 bit
6	Manu3	Mask_Manu3	8 bit

Packet CAN of the EMCY. How it result from registers structure (see left)

COB	ID of the propagation device
BYTE 1 = Error_code **(Low)**	
BYTE 2 = Error_code **(hight)**	
BYTE 3 = Error_reg	
BYTE 4 = Manu 1 **(Low)**	
BYTE 5 = Manu 1 **(hight)**	
BYTE 6 = Manu 2 **(Low)**	
BYTE 7 = Manu 2 **(hight)**	
BYTE 8 = Manu 3	

TRANSLATION OF AN EMCY FROM CAN 0 TO CAN 1:

In order to intercept an EMCY from CAN 0, the following is needed:

- Select the folder "FROM CAN 0" at the top of the EMCY window.
- Fill in the field "ID_EMCY" with the address of the CAN 0 device where the EMCY will be intercepted.
- Write 0 in the fields:
  - "**Enable_Mask_Error_Code"** = 0,
  - "**Enable_Mask_Error_Reg"**= 0,
  - "**Enable_Mask_Manu1**" = 0,
  - "**Enable_Mask_Manu2**" = 0,
  - "**Enable_Mask_Manu3**"= 0.
- Check the box "Enable_Translate_to_CAN1"
- Then press the button, "New EMCY" at bottom of the window.

These operations enables the Gateway:

- to intercept all the EMCY coming from devices with a specific address from "ID EMCY" in the CAN 0.
- replicate the EMCY definitions mentioned above in CAN 1.

The EMCY replicates are the same as those intercepted with the only difference being that the CAN 0 devices will see the address of the CAN 1 side of the Gateway and not the CAN 1 device that generated them.
(note: they will not see the number in the ID_EMCY).

If you want to also pass the address of the CAN 0 generating device, you must renounce one data component of the 8 byte in the original EMCY. To do this, refer to the section "Alias USE".
Of course, by doing this it is necessary that the CAN 1 devices understand how to interpret the registers in order to know where the EMCY derives from.

EXAMPLE OF THE TO SETTING A FILTER FOR THE EMCY:

ACTION:

The device on the CAN 0 of the ID 10 generates and therefore passes an EMCY to the CAN 0.

CONSEQUENCE:

The Gateway (ID 27 on the CAN 1) verifies the set conditions on the window "SET Translate EMCY". So then it passes the generated EMCY from CAN A to CAN 1.

EXAMPLE OF THE CONDITION:

The translation must be done when the ERROR CODE register of the generated EMCY takes the value, for example = 0x0B15.
In this case, the message must be translated from CAN 0 to CAN 1 (Note: the filter functions therefore in all other cases):

Therefore: **(see EMCY structure and the correspondent CAN Package)**

"Error Code"= 0x**0B15**

Means when:

Byte1 = **00001011** Byte2 = **00010101,**

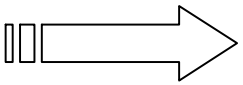
In this case the following fields are inserted in the window **"SET Translate EMCY"**:

- ID_EMCY = **10**
- Mask_Error_Code = 0x**0B15** **(0000101100010101)**
- Enable_Mask_Error_Code (**1111111111111111) (All the BITS of Error Code will be examined).**
- Enable_Translate_to_CANB must be checked.

(Note: the window "SET Translate EMCY" accepts decimal and hexadecimal values in the format with the prefix "0x" or "$").

Packet CAN of the EMCY that are generated in CAN A:

COB	ID **10**
	BYTE 1 = **0x0B**
	BYTE 2 = **0x15**
	BYTE 3 = Error_Reg
	BYTE 4 = Manu 1
	BYTE 5 = Manu 1
	BYTE 6 = Manu 2
	BYTE 7 = Manu 2
	BYTE 8 = Manu 3



Packet CAN of the EMCY that are transmitted in CAN B by the Gateway

COB	ID **27**
	BYTE 1 = **0x0B**
	BYTE 2 = **0x15**
	BYTE 3 = Error_Reg
	BYTE 4 = Manu 1
	BYTE 5 = Manu 1
	BYTE 6 = Manu 2
	BYTE 7 = Manu 2
	BYTE 8 = Manu 3

VARIATION ON THE PREVIOUS FILTER CONDITION:

In this case the "SET Translate EMCY" window is set up with the following fields:

- ID_EMCY = **10**
- Mask_Error_Code = 0x**0B15** **(0000.1011.0001.0101)**
- Enable_Mask_Error_Code = 0x03FF **(0000.0011.1111.1111) (**all the BIT of Error Code will be examined).
- Enable must be checked.

For all the values of the "Mask_Error_Code" register equal to XXXX XX11 0001 0101, the message will pass from CAN 0 to CAN 1. Therefore the most significant 6 bit of the "Error_Code" register result as indifferent.

SPECIFIC LIMITATION OF THE FILTER MASK:

ACTION:
We want the EMCY to translate if:

Its "Error Code" Register has the value 0x007C or
Its "Error Code" Register has the value 0x0063, or
Its "Error Code" Register has the value 0x0062

(Note: the OR operations in all above conditions)

CONSEQUENCE:

The Gateway can transmit the EMCY only with values raise the same bits, but in this case the messages also transmits with other specific conditions.

MOTIVE:

1° valore di Error_Code per traslare EMCY 0x007B = 0000 0000 011**1 1**01**1**
2° valore di Error_Code per traslare EMCY 0x0063 = 0000 0000 011**0 0**01**1**
3° valore di Error_Code per traslare EMCY 0x0062 = 0000 0000 011**0 0**01**0**

Enable_Mask_Error_Code to activate the comparison 1111 1111 111**0 0**11**0**
Mask_Error_Code to compare 0000 0000 0110 0110

The Mask must be calculated by doing the operations NOT XOR BIT to BIT of all values to be intercepted.

Instead, the activation must be calculated by doing the operations AND BIT to BIT of all values to be intercepted..

And so all the EMCY that will have the following "ERROR CODE" values, they will transmit.

0x0062 = 0000 0000 011**0 0**01**0**
0x0063 = 0000 0000 011**0 0**01**1**
0x006A = 0000 0000 011**0 1**01**0**
0x006B = 0000 0000 011**0 1**01**1**
0x0072 = 0000 0000 011**1 0**01**0**
0x0073 = 0000 0000 011**1 0**01**1**
0x007A = 0000 0000 011**1 1**01**0**
0x007B = 0000 0000 011**1 1**01**1**

Note how the BITS that are undetermined, create the extra EMCY values.

SUMMARY OF THE EMCY FILTER:

We already established that for each generating ID there is the possibility of an EMCY.
The EMCY generated by the device and the respective filter for gateway are composed of the following:

- 5 Registers (Error_Code, Error_Reg, Manu1, Manu2, Manu3 respectively 16, 8, 16, 16; 8 BIT); (note: they are the data received by the EMCY CAN Package).
- 5 masks used to compare the 5 registers, of course, of the same dimension in BITS as the registers (respectively mask_eq_ec, mask_eq_er, mask_eq_m1, mask_eq_m2, mask_eq_m3).
- 5 activations BIT to BIT of the masks ((Enable_Mask_Error_Code, Enable_Mask_Error_Reg, Enable_Mask_Manu1, Enable_Mask_Manu2, Enable_Mask_Manu3, respectively 16, 8, 16, 16; 8 BIT).

CONSIDERATIONS:

When all BITS of all activation registers are at zero, all EMCY are transmitted by the filter, because there is not a single BIT that actives the comparison (BIT to 1). This is true for any value of entering data (5 EMCY registers generated) and for any mask value.

SET TRANSLATE PDO:

Section "SET Translate PDO"

The Configurable CANopen Gateway has three PDO in output for each BUS according to the standard CANopen.

The user who must pass a PDO from CAN 0 to CAN 1 needs to insert the coordinates of the PDO to be transmitted in the field "SET Translate PDO" of the window.

By pressing the "Set Translate PDO" button from the Main window for SW67121 (Fig. 3) the window "Define Translate PDO" appears (Fig. 9):

- In the field **"cobid"** insert the Cob_ID of the original PDO,
- In the field **"id_dev_ori"** insert the address of the original device of **CAN 0** (note: an alias can be inserted in the field instead of the actual address of the PDO generator),
- In the field **"en_translate"** insert the number 1 (Note: there are two values: 1 the PDO being transmitted; 0 the PDO that is only defined).

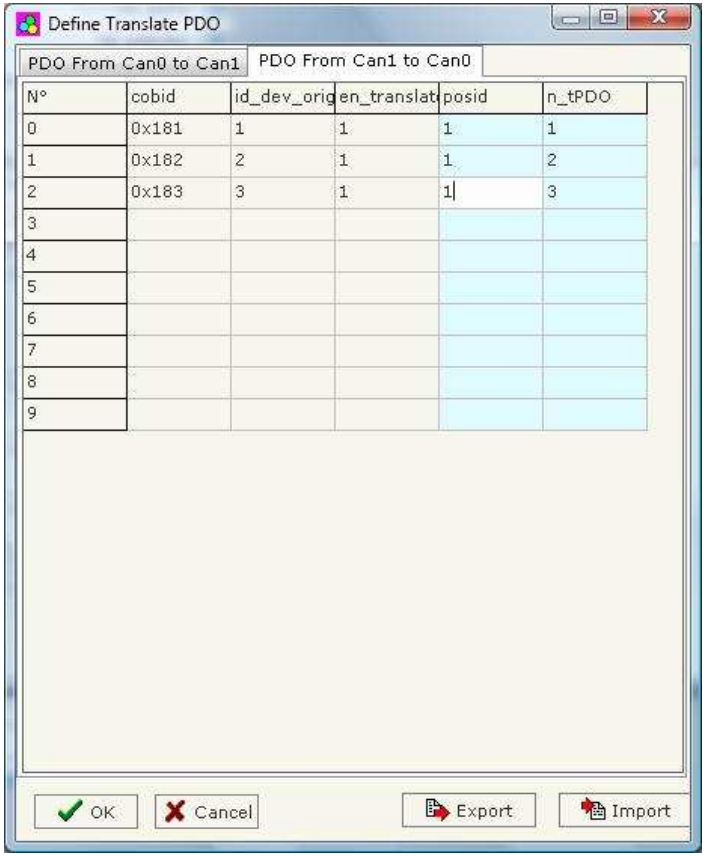
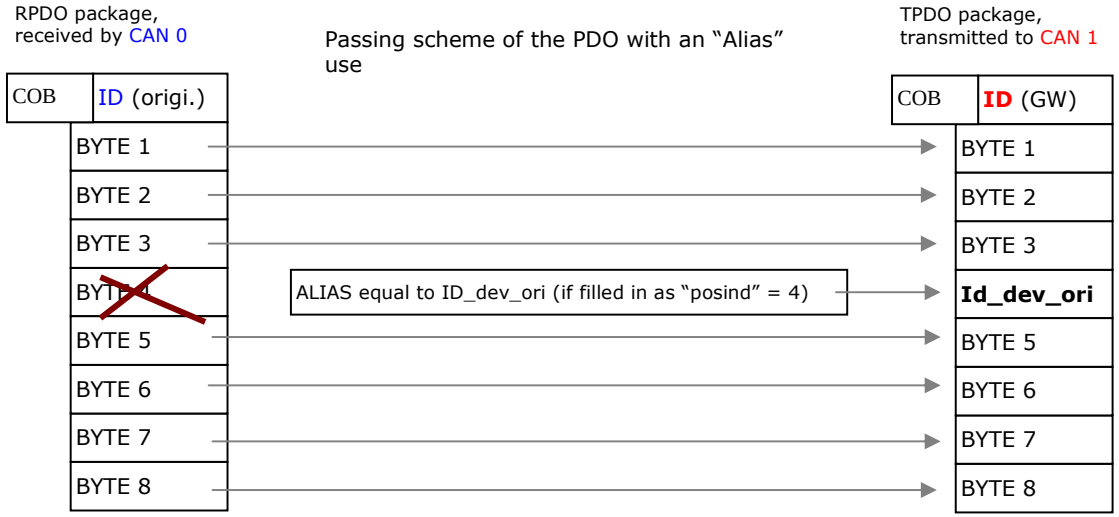


Figure 9: "Define Translate PDO" window

This way the user creates a corresponding PDO in CAN 1 that will have one of three CobID choices that the Gateway has on the CAN 1 side.

The new PDO is created by completing the remaining fields:

- in the field "posind", insert the pointer in one of 8 bytes of the CANopen package transmitted in the CAN 1, (values 0,1,2,3,4,5,6,7,8, with 0 signifying that "id_dev_ori" is lost in the PDO translated in CAN 1).
- In the field "n_tpdo", insert the number of the output PDO (of the 3 that the gateway has on the CAN 1 side). The transmitted PDO exits (values 1,2 or 3) .



UPDATE DEVICE:

Section "UP Date Device":
Insert the boot jumper, see figure 2.
In order to load the parameters after they are set, set the com port you used for update, you must click the button "execute update firmware" on the principal window.

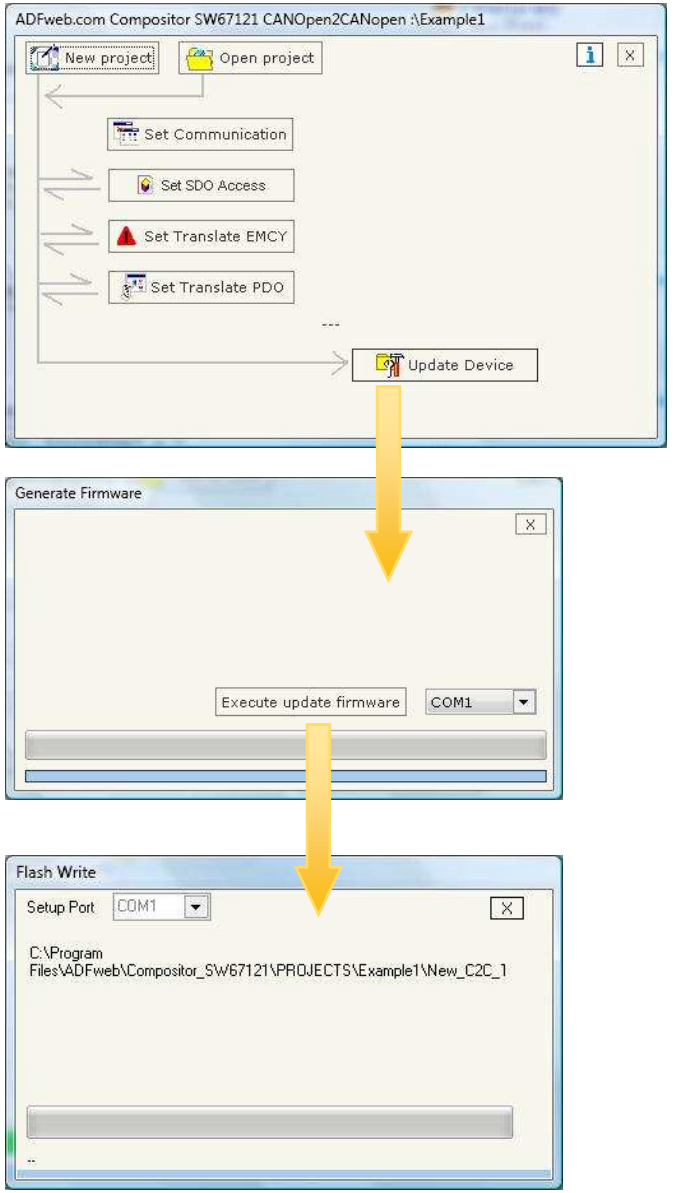


Figure 10: Update device procedure.

CHARACTERISTICS OF THE CABLES:

The connection from RS232 socket to a serial port (example one from a personal computer), must be made with a Null Modem cable (a serial cable where the pins 2 and 3 are crossed).
It is recommended that the RS232 Cable not exceed 15 meters.

The connection at Ethernet socket must be with a Ethernet Cable with a RJ45 Plug

The connection at RS485 socket must be done with twisted and shielded cable.
The terminal resistor must be inserted when the HD67102 is at the end of the line, using the Terminator jumper.

Can bus cable characteristics:

DC parameter:		Impedance	70 Ohm/m
AC parameters:		Impedance	120 Ohm/m
		delay	5 ns/m
Length		**Baud Rate [bps]**	**Length MAX [m]**
		10 K	5000
		20 K	2500
		50 K	1000
		100 K	650
		125 K	500
		250 K	250
		500 K	100
		800 K	50
		1000 K	25

MECHANICAL DIMENSIONS:

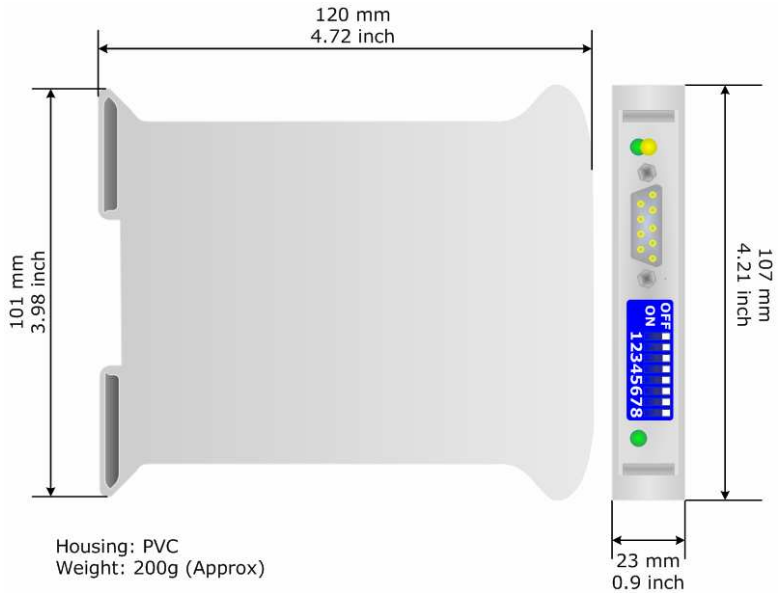


Figure 11: Mechanical dimensions scheme

ORDER CODE:

Order Code: **HD67121** **-** Gateway – CANopen to Modbus RTU Slave

ACCESSORIES:

Order Code: **AC34107** **-** Null Modem Cable Fem/Fem DSub 9 Pin 1,5 m

Order Code: **AC34114** - Null Modem Cable Fem/Fem DSub 9 Pin 5 m

Order Code: **AC34001** **-** Rail DIN - Power Supply 220/240V AC 50/60Hz – 12 V AC

Order Code: **AC34002** **-** Rail DIN - Power Supply 110V AC 50/60Hz – 12 V AC

WARRANTIES AND TECHNICAL SUPPORT:

For fast and easy technical support for your ADFweb.com SRL products, consult our internet support at www.adfweb.com.
Otherwise contact us at the address support@adfweb.com

RETURN POLICY:

If while using your product you have any problem and you wish to exchange or repair it, please do the following:

1) Obtain a Product Return Number (PRN) from our internet support at www.adfweb.com. Together with the request, you need to provide detailed information about the problem.
2) Send the product to the address provided with the PRN, having prepaid the shipping costs (shipment costs billed to us will not be accepted).

If the product is within the warranty of twelve months, it will be repaired or exchanged and returned within three weeks. If the product is no longer under warranty, you will receive a repair estimate.

PRODUCTS AND RELATED DOCUMENTS:

Part	Description	URL
HD67121	Gateway CANopen / Canopen	www.adfweb.com?Product=HD67121
HD67001	Gateway CANopen / Modbus – RTU Master	www.adfweb.com?Product=HD67001
HD67004 HD67005	Gateway CANopen / Modbus – Ethernet TCP	www.adfweb.com?Product=HD67004
HD67134	Gateway CANopen / DeviceNet	www.adfweb.com?Product=HD67134
HD67117	CAN bus Repeater	www.adfweb.com?Product=HD67117
HD67216	CAN bus Analyzer	www.adfweb.com?Product=HD67216